

Hearing Charter

COMMITTEE ON SCIENCE AND TECHNOLOGY SUBCOMMITTEE ON ENERGY AND ENVIRONMENT U.S. HOUSE OF REPRESENTATIVES

Environmental Research at the Department of Energy

Tuesday, June 9, 2009
10 a.m. – 12 p.m.
2318 Rayburn House Office Building

Purpose

On Tuesday, June 9, 2009 the House Committee on Science & Technology, Subcommittee on Energy and Environment will hold a hearing entitled “*Environmental Research at the Department of Energy.*”

The Subcommittee’s hearing will receive testimony on H.R. 2729 sponsored by Rep. Luján to authorize the seven existing National Environmental Research Parks as permanent research reserves and provides guidance for research, education, and outreach activities to be conducted on or in collaboration with the Parks. The hearing will examine how the Parks have been used to study long-term trends in the development of ecosystems, develop methods to monitor and remediate contaminants, and conduct environmental education and outreach programs. The hearing will also examine other climate and environmental research programs conducted by the Department of Energy (DOE) Office of Science.

Witnesses

- **Dr. Paul Hanson** is the Ecosystem Science Group Leader at Oak Ridge National Laboratory. Dr. Hanson will testify on DOE’s carbon cycle studies, with a focus on experimentation and measurement. He will also address the importance and utility of the Oak Ridge National Environmental Research Park.
- **Dr. David Bader** will testify on his role as the Director of the Program for Climate Model Diagnosis and Intercomparison, which conducts comparative computational modeling studies and synthesizes the U.S. contribution to research coordinated by the Intergovernmental Panel on Climate Change.
- **Dr. Nathan McDowell** is a lead researcher in the Atmospheric, Climate, and Environmental Dynamics Group at Los Alamos National Laboratory. Dr. McDowell will testify on research and educational activities conducted by the Los Alamos National Environmental Research Park.

- **Dr. Whit Gibbons** is Professor Emeritus of Ecology at the University of Georgia and Head of the Environmental Outreach and Education program at the Savannah River Ecology Laboratory (SREL). He has also been involved in collecting and managing several long-term sampling programs at the Savannah River National Environmental Research Park.

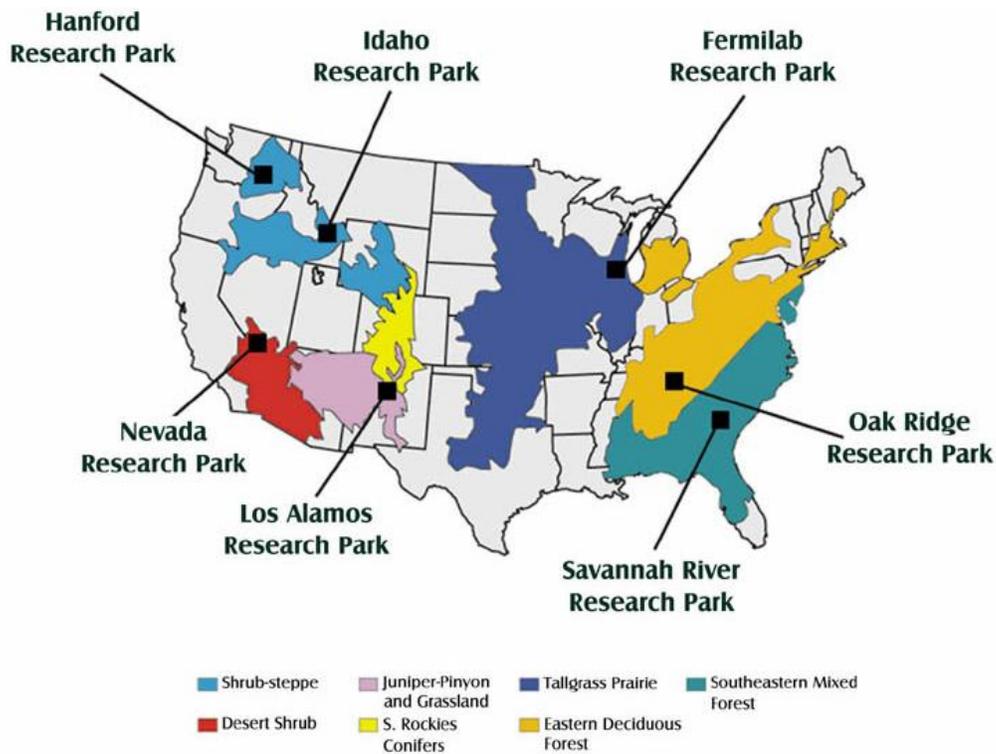


Figure 1: Department of Energy National Environmental Research Parks and Associated Ecoregions

Background

National Environmental Research Parks

The National Environmental Research Parks (NERPs) are unique outdoor laboratories that provide opportunities for environmental studies on protected lands around DOE facilities. They offer secure settings for long-term research on a broad range of subjects, including biomass production, environmental remediation, plant succession, population ecology, ecological restoration, and thermal effects on freshwater ecosystems. The Parks also provide rich environments for training researchers and introducing the public to ecological sciences.

Interest in the use of radionuclides in ecological research evolved after World War II. To ensure the security and safety of the nation’s work on nuclear weapons, the government established laboratories in isolated regions surrounded by large buffer zones of undeveloped land. DOE's predecessor, the Atomic Energy Commission (AEC), began to recognize the need to track both

Site	Year Designated	Acres	Ecoregion
Savannah River	1972	198,000	Southern Mixed Forest
Los Alamos	1973	28,400	Juniper-Pinyon and Grassland
Idaho	1975	568,000	Shrub-steppe
Oak Ridge	1980	21,500	Eastern Deciduous Forest
Hanford	1983	366,000	Shrub-steppe
Fermilab	1989	6,800	Tallgrass Prairie
Nevada	1992	865,000	Desert Shrub

Table 1: Details on the seven National Environmental Research Parks

radioactive fallout from the testing of nuclear weapons and inadvertent radioactive releases from nuclear weapons production facilities into the environment. Out of the radionuclide research grew new technologies for quantifying the movement both of natural materials such as nutrients and fluids and of introduced pollutants through the ecosystem.

In 1970, the Office of Science and Technology Policy provided President Nixon with ten recommendations on the stewardship and use of federal lands. One of these was to utilize federal lands to conduct research on ecosystems and wildlife biology and preservation. In 1972 AEC established its first research park at the Savannah River Site in South Carolina. The plan for a research park emerged during a formal review of the environmental research activities at Savannah River. The review team consisted of scientists, representatives from other Federal agencies, and members of the newly formed President's Council on Environmental Quality. Four years later, DOE released a charter and directives for current and future research parks, initially shaped by the recommendations of this team.

The seven National Environmental Research Parks are located within six major ecological regions of the United States (Figure 1), covering more than half of the nation. More information on each can be found in Table 1 above.

The mission of the research parks is to: conduct research and education activities to assess and document environmental effects associated with energy and weapons use; explore methods for eliminating or minimizing adverse effects of energy development and nuclear materials on the environment; train people in ecological and environmental sciences; and educate the public. The Parks maintain several long-term data sets that are available nowhere else in the U.S. or in the world on amphibian populations, bird populations, and soil moisture and plant water stress. This data is uniquely valuable for the detection of long-term shifts in climate.

(dollars in thousands)

	FY 2008	FY 2009	FY 2010
Climate and Environmental Sciences			
Atmospheric System Research	25,201	25,316	26,452
Environmental System Science	77,816	79,631	82,558
Climate and Earth System Modeling	35,141	72,029	69,775
Climate and Environmental Facilities and Infrastructure	88,944	94,450	99,479
SBIR/STTR	—	7,299	7,442
Total, Climate and Environmental Sciences	227,102	278,725	285,706

Table 2: Budget table for the DOE Office of Science's Climate and Environmental Sciences program. FY 2008 and FY 2009 are appropriated levels, and FY 2010 is the Administration's request level. This does not include funding from American Recovery and Reinvestment Act of 2009, which has not yet been allocated in further detail.

Over the years since their establishment, there have been thousands of scientific papers published on the environmental studies done at the NERPs. The research at these sites has been conducted by DOE scientists, scientists from other federal agencies, universities and private foundations.

The maintenance of the Parks by DOE meets the Department's statutory obligations to promote sound environmental stewardship of federal lands and to safeguard sites containing cultural and archeological resources.

DOE Research in Climate and Environmental Sciences

Climate and Environmental Sciences is a major component of the DOE Office of Science's Biological and Environmental Research program. It focuses on developing a comprehensive understanding of the fundamental science associated with carbon cycling and climate change and developing monitoring and remediation methods to address the control and clean up of environmental contaminants on DOE facilities. Climate and Environmental Sciences supports three research activities and two national scientific user facilities. The Climate and Earth System Modeling activity focuses on development, evaluation, and use of large-scale computational models to determine the impacts and possible mitigation of climate change. Atmospheric System Research seeks to resolve two areas of uncertainty in climate change projections: the role of clouds and the effects of aerosol emissions on the atmospheric radiation (heat) balance of the earth. The Environmental System Science program supports research to understand the effects of climate change on terrestrial ecosystems, the role of terrestrial ecosystems in global carbon cycling, and the role of subsurface biochemical processes on the transport and fate of contaminants, including heavy metals and radionuclides. Two scientific user facilities—the Atmospheric Radiation Measurement Climate Research Facility (ACRF) and the Environmental Molecular Sciences Laboratory (EMSL)—provide the scientific community with technical capabilities, scientific expertise, and unique information to facilitate research in the above-

mentioned areas. Details on current and proposed funding for Climate and Environmental Sciences can be found in Table 2.

Atmospheric Science Program

The emphasis for the Atmospheric Science program is on understanding the effects of aerosols on climate. The program is focused on understanding atmospheric processes that influence transport, transformation, and fate of trace chemicals and particulate matter associated with energy use and that are generated through natural processes. This work is done as part of the U.S. Global Change Research Program in coordination with the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA). The Intergovernmental Panel on Climate Change (IPCC) fourth assessment report identified cloud simulation as a major source of uncertainty in climate models. Improvement in this area could reduce the range of projected increases in Earth's average surface temperature could be narrowed significantly. With regard to aerosols, the challenge is further complicated by the variety of compositions, shapes, and sizes of aerosol particles and the fact that they can act to either enhance or offset warming. This research seeks to increase the reliability of atmospheric process representations and interactions among processes that are needed inputs for the development of the next generation of climate models.

Environmental System Science

Environmental System Science covers three major research thrusts:

- The Terrestrial Ecosystem Science program focuses on determining the effects of climate change on the structure and functioning of terrestrial ecosystems, understanding the processes controlling the exchange rate of carbon dioxide (CO₂) between atmosphere and terrestrial biosphere, and improving the reliability of global carbon cycle models for predicting future atmospheric concentrations of CO₂. Experiments involving controlled manipulations of climate factors such as precipitation, temperature, and atmospheric CO₂ concentration are conducted to examine cause-and-effect relationships between climate changes and effects on ecosystems. This activity also supports AmeriFlux, the interagency network for directly measuring net sources and sinks of CO₂ by terrestrial ecosystems.
- The Terrestrial Carbon Sequestration program supports research to: identify the physical, biological, and chemical processes controlling soil carbon input, distribution, and longevity; develop models of these systems to project future scenarios of carbon storage or release in terrestrial systems; and seek ways to exploit these processes to enhance carbon sequestration in terrestrial ecosystems. Current research focuses on switchgrass ecosystems associated with DOE's cellulosic ethanol R&D program.
- The Subsurface Biogeochemical Research program addresses fundamental science questions at the intersection of biology, geochemistry, and physics to determine the transport and fate of contaminants in subsurface environments. This research effort focuses in particular on processes that control the mobility of radionuclides in the

environment, which will help address DOE strategic initiatives for cleanup and monitoring of the Department's nuclear energy-related and former nuclear weapons development sites. This activity currently supports field research sites in Colorado, Tennessee, and Washington to obtain samples for further evaluation in the laboratory and to test laboratory-derived hypotheses regarding subsurface transport at the field scale. These sites also are important for testing and evaluating computer models that describe contaminant mobility in the environment. In addition, this activity will assist DOE's research on using deep geological formations to store CO₂ taken from the atmosphere.

Climate and Earth System Modeling

The Climate and Earth System Modeling program covers several areas of large-scale computational research. It examines the processes needed to improve the coupled atmosphere, ocean, land, and sea ice models for simulating climate variability and change over decadal to centennial time scales with a current focus on incorporating advanced representations of cloud-aerosol and carbon-cycle interactions. It also supports climate model diagnosis and comparison, as well as the development and improvement of metrics and diagnostic tools for evaluating model performance. Over the next several years, analyses will be conducted on a suite of global climate modeling experiments that are currently being planned under the auspices of the World Climate Research Program which addresses the scientific priorities identified by the IPCC. DOE takes a lead role in coordinating the U.S. contribution to these international climate research activities with other federal agencies, in particular the National Science Foundation (NSF), NOAA, and NASA.

An important additional component supported under this program is the development of "integrated assessment models". These models provide advanced quantitative tools for exploring the implications of policy decisions and technological innovations on our energy, environmental, and economic futures. They integrate physical and social science research to inform decision-makers of the potential impacts of and uncertainties in their options. Understanding the role of present and possible future energy technologies and their implications for greenhouse gas emissions is also a major focus of this research.

Climate and Environmental Facilities and Infrastructure

DOE's Climate and Environmental Sciences subprogram supports two significant user facilities:

- The Atmospheric Radiation Measurement Climate Research Facility (ACRF) is unique in that it is a multi-platform facility, with stationary and mobile instruments at fixed and varying locations around the globe. ACRF provides continuous field measurements of climate data to improve our understanding of atmospheric processes and promote the advancement of climate models through observations of atmospheric phenomena. The stationary sites provide scientific testbeds in three different climate regions (mid-latitude, polar, and tropical). The two mobile facilities provide a capability to address high priority scientific questions in other regions. And the ACRF's aerial capability provides in situ cloud and radiation measurements that complement ground-based measurements.

- The William R. Wiley Environmental Molecular Sciences Laboratory (EMSL) at Pacific Northwest National Laboratory provides an integrated suite of resources that enable scientists to combine theory and computational modeling with experimental data to develop a molecular-level understanding of the physical, chemical, and biological processes that influence the movement, transformation and fate of contaminants. EMSL's users currently include 742 different institutions in 68 countries. All resources housed within EMSL are available at no cost to researchers if their research results are shared in the open literature, and access to these resources is awarded on a peer-reviewed basis. EMSL's capabilities include: a supercomputer designed specifically to solve large chemistry and biochemistry problems; a series of advanced spectrometers to examine biochemical processes as they occur; surface deposition instruments to study and design materials at the atomic and molecular scales; and high-precision subsurface flow and transport tools to measure, model, and predict the transport and fate of environmental contaminants.